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Drop Size Spectra of Dipel 8L and Thuricide 48LV Atomized with a Micronair

DROP SIZE SPECTRA OF DIPEL 8L AND THURICIDE 48LV ATOMIZED WITH A MICRONAIR

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PREFACE

The purpose of this wind tunnel test was to establish drop size characteristics of Dipel 8L and Thuricide 48LV atomized with a Micronair. Results will be used by the USDA Forest Service in developing prescriptions for applying pesticides, and in selecting nozzle types and position on spray booms. Data are used also as input to mathematical models which predict spray coverage, canopy penetration, and off-target drift. Wind tunnel tests help to provide these data to achieve optimum droplet spectra and application rates.

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Introduction:

Tests were conducted in a wind tunnel to measure the drop size spectra produced by a Micronair AU5000 with a spray containing one part Dipel 8L to three parts water, and a spray containing one part Thuricide 48LV to two parts water.

Equipment:

A Micronair AU5000 spinner with a standard 3.63 inch blade was used for all tests. The tests were conducted in a wind tunnel with a test section 8 ft. long and a 2 x 2 ft. crossection. A Particle Measurement System (PMS) probe, OAP-2D-GA1, with a PMS 11-C data acquisition system was used to measure the drop size spectra. The probe has a nominal class size 33 μm. The system counts and classifies the drops into 62 size classes from 28 to 2062 μm.

Procedures:

The desired flow rate 1.56 gpm, was based upon an application rate of 96 oz/acre with the application parameters listed in Table I. Table II shows the VRU orifice setting and pressure required to obtain the flow rate of 1.56 gpm. The flow rate was determined by measuring the volume of liquid collected for a given time interval. The blade angle on the Micronair was adjusted to 55° for all tests. The airspeed was measured with a pitot tube and the motor on the wind tunnel adjusted to give an airspeed of 110 mph.

The drop size measurement procedures were similar to previous protocol developed for testing rotary atomizers. Briefly, the PMS probe was mounted in the wind tunnel with the laser beam located 5.25 inches above the bottom of the wind tunnel test section and 24" downstream from the rear of the rotary atomizer. For the test with Dipel 8L, the atomizer was positioned vertically at 6 positions that represented five equal rings of sample area (62.3 in^2) plus one center area of 12.6 in^2 directly behind the cage section. The drop size frequency data for each area was combined into a single composite spectrum.

The tests with Thuricide were modified slightly to increase the number of sample areas to a total of 9 from the previous number of 7. For these tests, the spinner was positioned at 9 positions that represented 8 equal areas, 37.7 in^2, plus one center area of 12.6 in^2.

Results:

Table III is a summary of the drop size spectra for the two formulations at the selected air speed, flow rate and blade setting. The nomenclature used is as follows:

$D_{V.1}$ = Diameter that contains 10% of volume in drops of smaller size.

$D_{V.5}$ = Diameter that contains 50% of volume in drops of smaller size.

(Volume median diameter)

$D_{V.9}$ = Diameter that contains 90% of volume in drops of smaller size.

$$\text{Relative Span} = \text{R.S.} = \frac{D_{V.9} - D_{V.1}}{D_{V.5}}$$

The complete spectrum and statistical results for the tests with Dipel are reported in Table IV and illustrated in Fig. 1. The data are for a combination of two replicate composite tests using the above sample procedures with 7 sample areas. In addition, another test was conducted with Dipel using 9

sample areas. Results from the two procedures were not significantly different.

Table V and Fig. 2 illustrate the drop size results for the tests with Thuricide. These tests were conducted with 9 sample areas. Again, the reported results are for a combination of two replicate tests.

Two tests were conducted using a Micronair AU5000 with a blade setting of 55^{o} in a wind tunnel at 110 mph. Test #1 used a formulation of 1 part Dipel 8L to 3 parts water at a flow rate of 1.56 gpm. Test #2 used a formulation of 1 part Thuricide 48LV to 2 parts water at the same flow rate. Both tests gave similar drop size spectra.

TABLE I

Flow rate required for an applicate rate of 96 oz/acre and selected application parameters.

Airspeed mph	Swath Width ft.	Total Flow Rate gpm	No. of Spinners	Flow Rate Per Spinner gpm
110	75	12.5	8	1.56

TABLE II

Adjustments required for an application rate of 96 oz/acre.

Test #	Flow Regulator	Pressure (psi)	Flow Rate gpm	Formulation
1	VRU #9	35	1.56	1 pt Dipel 8L:3 pt water
2	VRU #9	35	1.56	1 pt Thur. 48LV:2 pt water

TABLE III

Summary of drop size spectrum from a Micronair AU5000 atomizer with a 55° blade setting.

Formulation	Airspeed mph	Flow Rate gpm	Spinner rpm	$D_{V.1}$ µm	$D_{V.5}$ µm	$D_{V.9}$ µm	R.S.
1 pt Dipel 8L:3 pt water	110	1.56	4600	90	146	198	0.73
1 pt Thur. 48LV:2 pt water	110	1.56	4600	91	148	211	0.81

TABLE IV

AU5000,110 RPM,1.6 GPM,1 PART DIPEL 8L,3 PARTS WATER

DTG 85/05/17 11:53:00

DFM=1.0--4.0 MHz

UPPER LIMIT	N(RAW)	N/SEC	gm/SEC	% N	% VOL.	ACCUMULATED % N	ACCUMULATED % VOL.
56	4058	4.46E 07	1.47	46.40	2.79	46.40	2.79
89	9910	1.70E 07	3.38	17.72	6.44	64.11	9.22
122	10173	1.54E 07	9.34	16.01	17.77	80.12	26.99
154	9346	1.18E 07	16.07	12.23	30.56	92.35	57.55
187	6658	5.86E 06	15.18	6.10	28.87	98.45	86.43
219	2039	1.29E 06	5.55	1.34	10.74	99.79	97.16
252	333	175384	1.19	0.18	2.27	99.97	99.43
284	49	21591	0.22	0.02	0.41	99.99	99.85
318	8	5430	0.08	0.01	0.15	100.00	100.00
351	1	111	0.00	0.00	0.00	100.00	100.00
382	0	0	0.00	0.00	0.00	100.00	100.00
TOTALS		9.61E 07	52.59				

TOTAL RAW PARTICLES.... 42575/54428-- 78.22%

NUMBER MEAN DIAMETER... 78.58 MICROMETERS S.D.... 45.00

VOLUME MEAN DIAMETER... 101.52 MICROMETERS S.D.... 119.12

SAUTER MEAN DIAMETER... 127.58 MICROMETERS

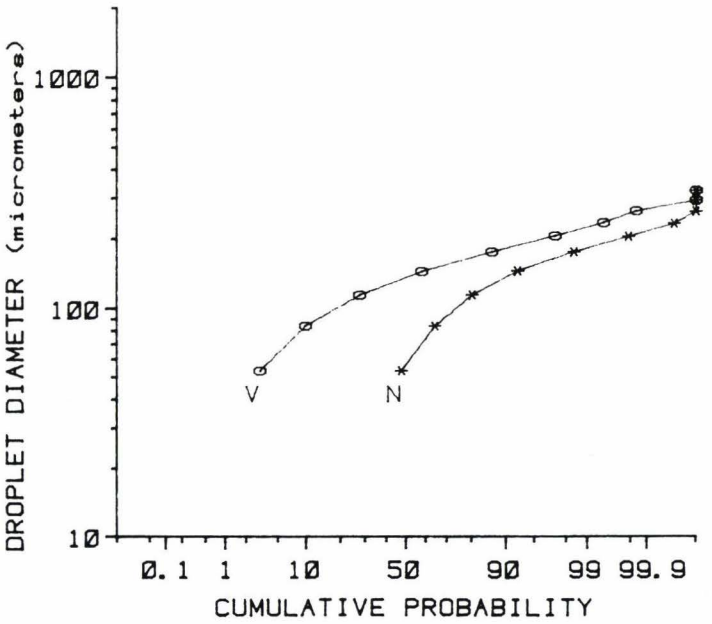
$D_{N0.1}$... 0.00 MICROMETERS $D_{V0.1}$... 90.38 MICROMETERS

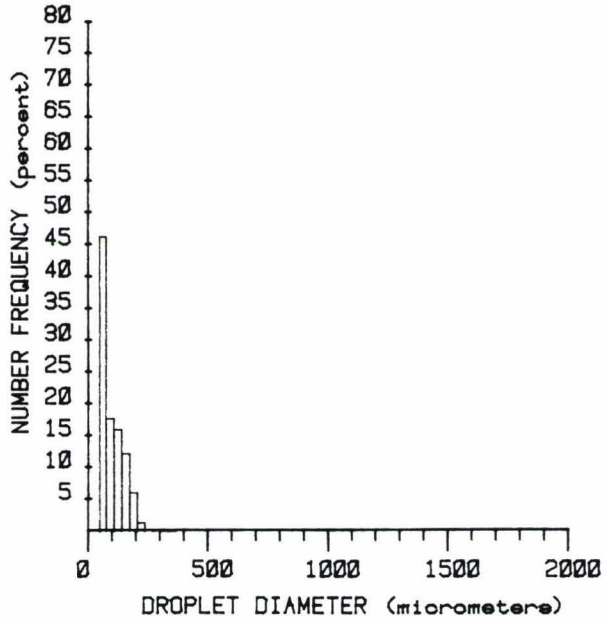
$D_{N0.5}$... 62.98 MICROMETERS $D_{V0.5}$... 146.45 MICROMETERS R.S.... 0.73

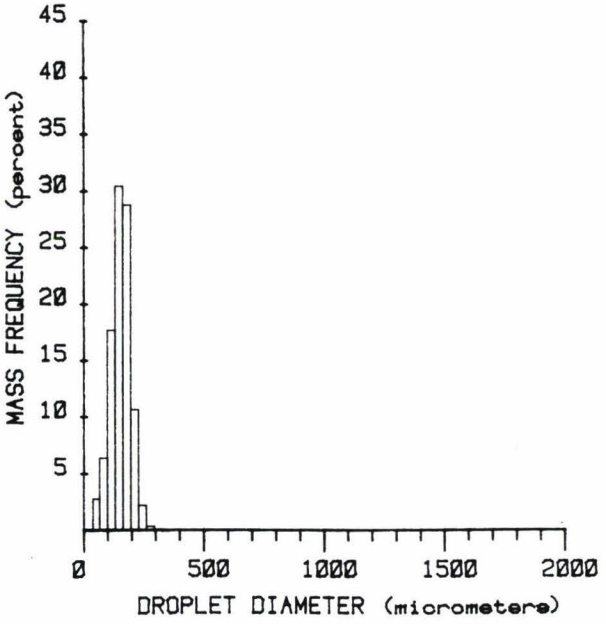
$D_{N0.9}$... 148.27 MICROMETERS $D_{V0.9}$... 197.93 MICROMETERS

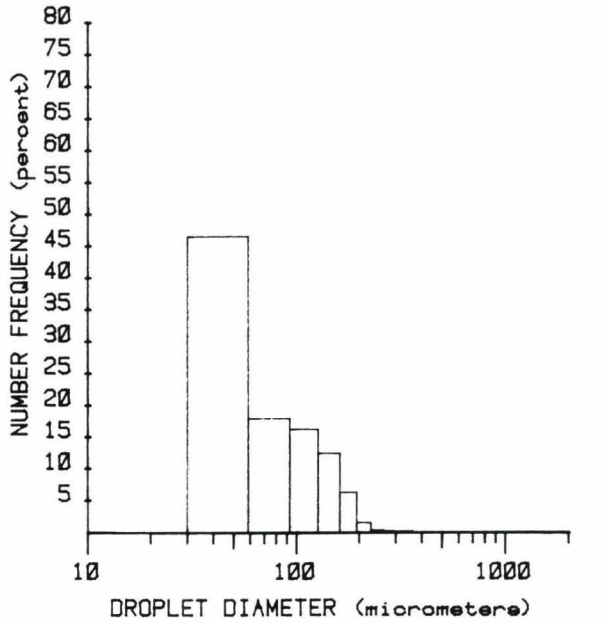
Nozzle Type..... *AU5000*
Nozzle Angle Rel.
to Airstream..... *0°*
Spray Pressure..... *35 PSI*
Airspeed..... *110 MPH*

Distance to Probe... *61 cm.*
Depth of Field..... *1.0 cm.*
Slice Rate..... *4.0 MHz*
Date..... *85/05/17*
Time..... *11:53:00*
File Number..... *11.1.60*









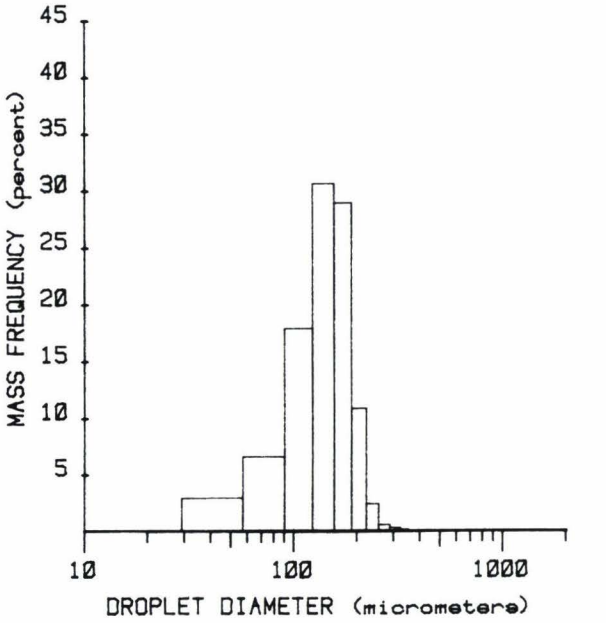


Fig. 1. Tests with Dipel 8L.

TABLE V

AU5000,110 MPH,1.5 GPM,1 PART THURICIDE 48LV,2 PARTS WATER

DTG 85/05/17 04:22:00

DFM=1.0--4.0 MHz

UPPER LIMIT	N(RAW)	N/SEC	gm/SEC	% N	% VOL.	ACCUMULATED % N	ACCUMULATED % VOL.
56	5120	5.16E 07	1.70	46.72	2.76	46.72	2.76
89	13251	1.95E 07	3.88	17.70	6.32	64.42	9.08
122	15292	1.82E 07	11.07	16.52	18.02	80.95	27.10
154	14110	1.27E 07	17.33	11.48	28.20	92.43	55.30
187	10995	6.02E 06	15.59	5.45	25.36	97.88	80.67
219	5256	1.82E 06	7.98	1.65	12.98	99.53	93.65
252	1550	422873	2.88	0.38	4.69	99.92	98.33
284	324	77170	0.78	0.07	1.26	99.99	99.59
318	61	11785	0.17	0.01	0.28	100.00	99.87
351	6	3497	0.07	0.00	0.11	100.00	99.98
382	2	444	0.01	0.00	0.02	100.00	100.00
414	0	0	0.00	0.00	0.00	100.00	100.00
TOTALS		1.10E 08	61.46				

TOTAL RAW PARTICLES.... 65967/84049-- 78.49%

NUMBER MEAN DIAMETER... 78.37 MICROMETERS S.D.... 45.52

VOLUME MEAN DIAMETER... 102.11 MICROMETERS S.D.... 122.84

SAUTER MEAN DIAMETER... 129.62 MICROMETERS

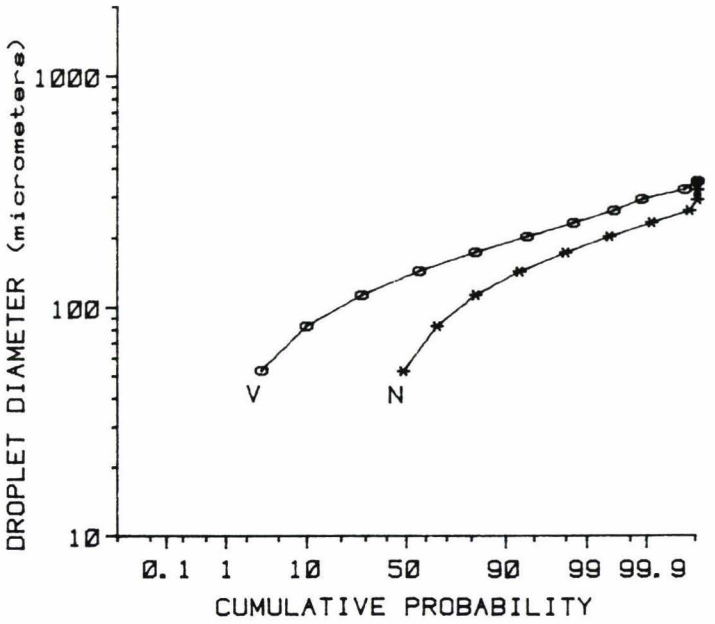
$D_{N0.1}$... 0.00 MICROMETERS $D_{V0.1}$... 90.62 MICROMETERS

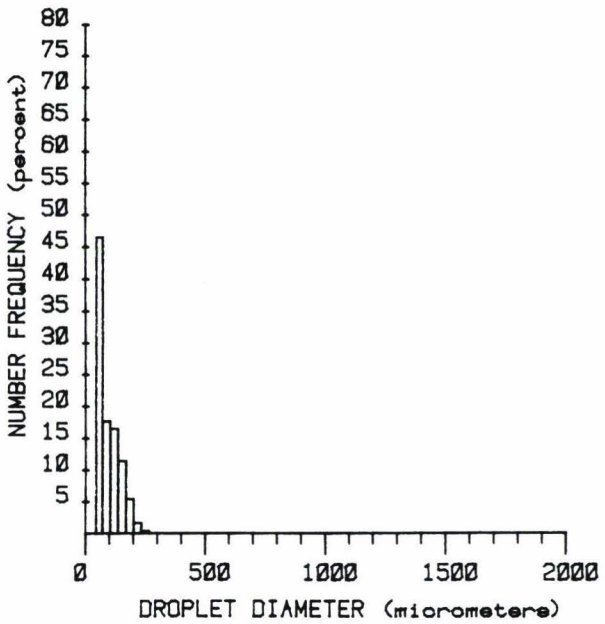
$D_{N0.5}$... 62.38 MICROMETERS $D_{V0.5}$... 148.40 MICROMETERS R.S.... 0.81

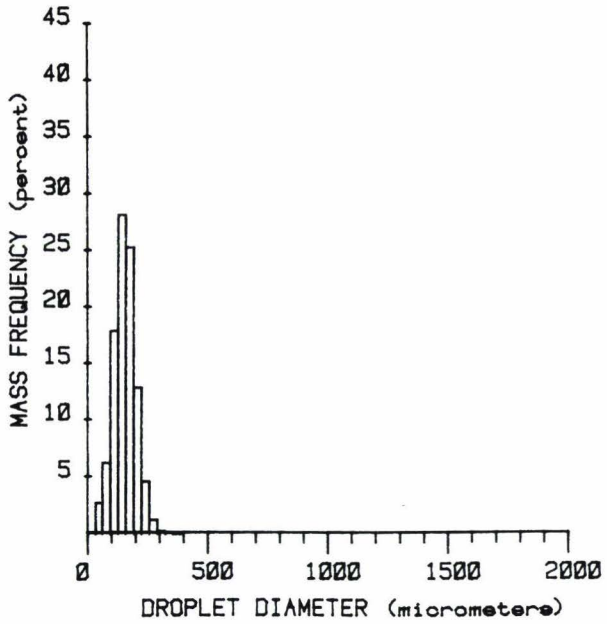
$D_{N0.9}$... 147.63 MICROMETERS $D_{V0.9}$... 210.63 MICROMETERS

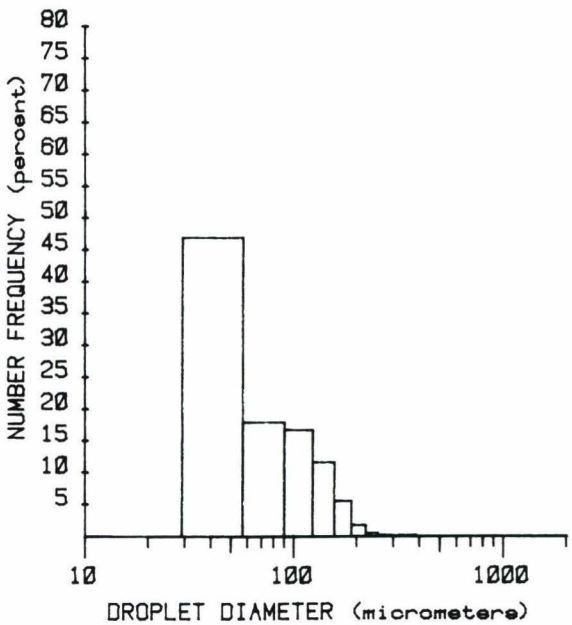
Nozzle Type..... *AU5000*
Nozzle Angle Rel.
to Airstream..... *0°*
Spray Pressure..... *35 PSI*
Airspeed..... *110 MPH*

Distance to Probe... *61 cm.*
Depth of Field..... *1.0 cm.*
Slice Rate..... *4.0 MHz*
Date..... *85/05/17*
Time..... *04:22:00*
File Number..... *11.1.61*









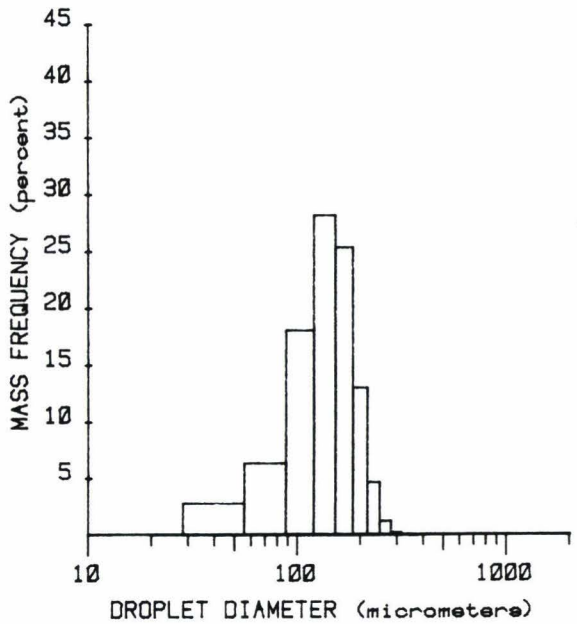


Fig. 2. Tests with Thuricide 48LV.